

# FOOD SAFETY EXPERT PANEL

## UPDATE ON INORGANICS IN CROPS



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Engineer

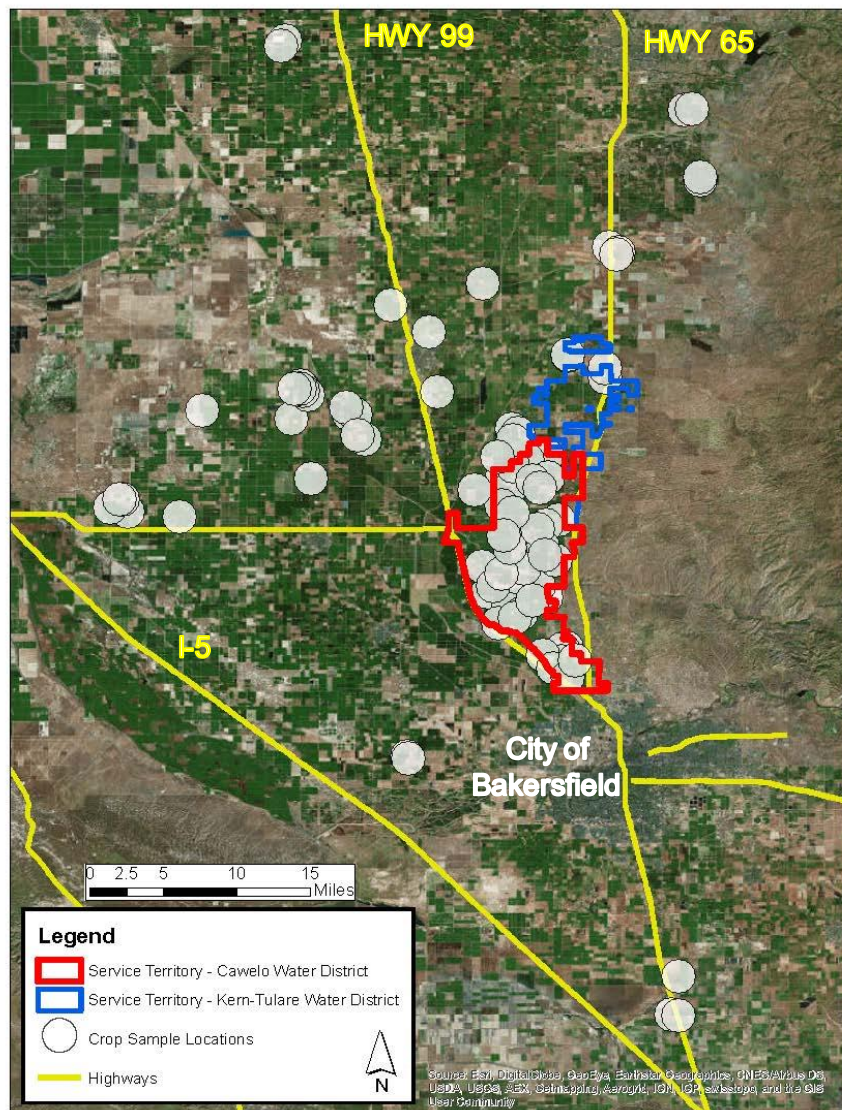


# Presentation Overview

- Project Background
- Crop Sample Results
- Historical Water Quality Results
- Map of Crop Results and Soil Type
- Summary

# Background

- Crop samples collected in 2017:
  - ◆ Almonds,
  - ◆ Citrus,
  - ◆ Garlic,
  - ◆ Grapes, and
  - ◆ Pistachios.
- Sites irrigated with produced wastewater (Treated Sites)
  - ◆ Kern-Tulare Water District
  - ◆ Cawelo Water District
- Sites not irrigated with produced wastewater (Control Sites)



# Crop Sample Results

- Crop Analysis:

- ◆ Metals,
- ◆ Volatile Organic Compounds, and
- ◆ Semi-Volatile Organic Compounds.

- Metals:

- |              |               |                 |
|--------------|---------------|-----------------|
| ◆ Antimony,  | ◆ Cobalt,     | ◆ Silver,       |
| ◆ Arsenic,   | ◆ Copper,     | ◆ Strontium,    |
| ◆ Barium,    | ◆ Lead,       | ◆ Thallium,     |
| ◆ Beryllium, | ◆ Molybdenum, | ◆ Vanadium, and |
| ◆ Cadmium,   | ◆ Nickel,     | ◆ Zinc.         |
| ◆ Chromium,  | ◆ Selenium,   |                 |

# Crop Sample Results

- Metal Analysis:

- ◆ EPA Method 6020A, and
- ◆ EPA Method 6020B.

- **Detectable Results Observed in Control and/or Treated Samples** (results are all non-detect)

- ◆ ~~Antimony,~~

- ◆ ~~Arsenic,~~

- ◆ **Barium,**

- ◆ ~~Beryllium,~~

- ◆ ~~Cadmium,~~

- ◆ ~~Chromium,~~

- ◆ ~~Cobalt,~~

- ◆ **Copper,**

- ◆ ~~Lead,~~

- ◆ **Molybdenum,**

- ◆ **Nickel,**

- ◆ ~~Selenium,~~

- ◆ ~~Silver,~~

- ◆ **Strontium,**

- ◆ ~~Thallium,~~

- ◆ ~~Vanadium, and~~

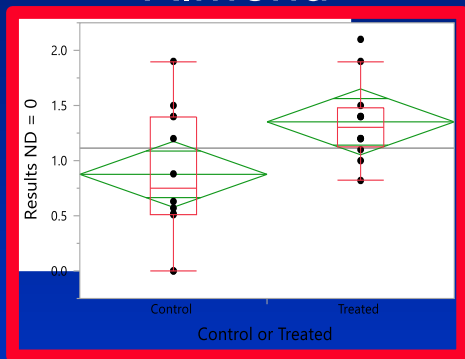
- ◆ **Zinc.**

# Barium

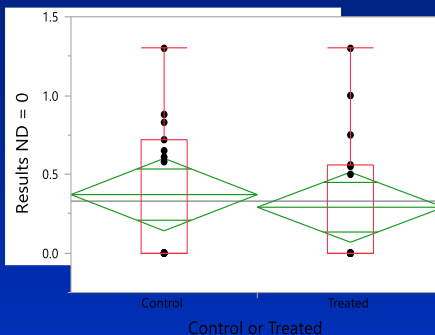
Units = mg/kg

Scales are different

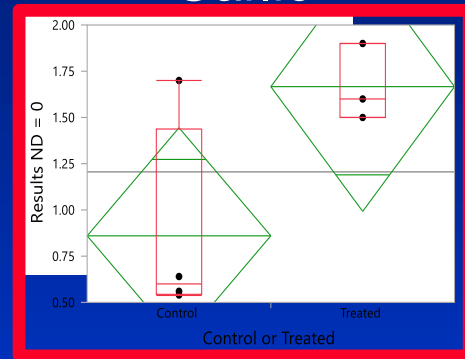
## Almond



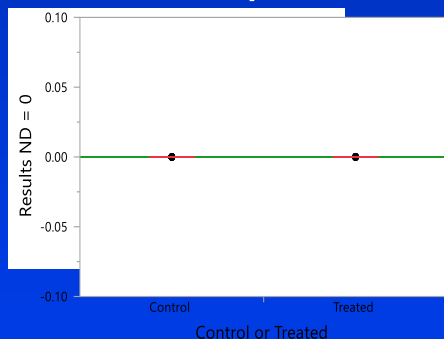
## Citrus



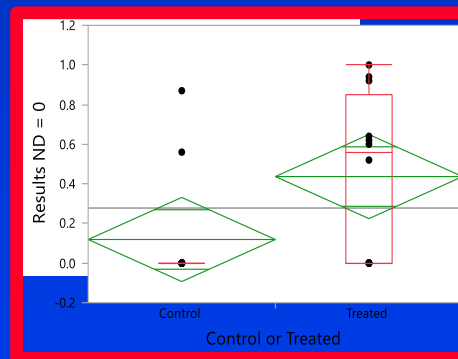
## Garlic



## Grape



## Pistachio

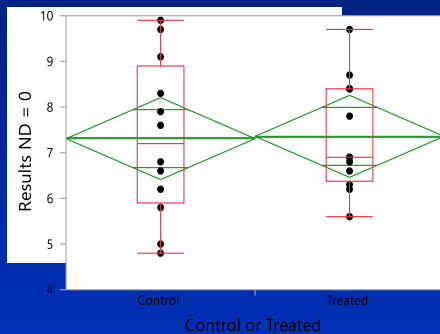


# Copper

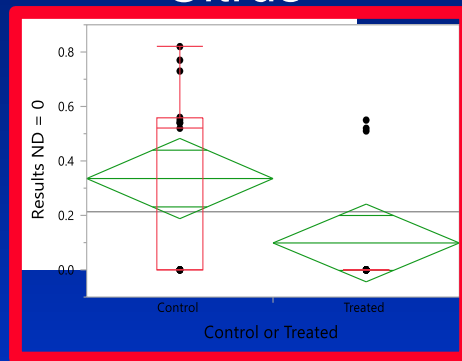
Units = mg/kg

Scales are different

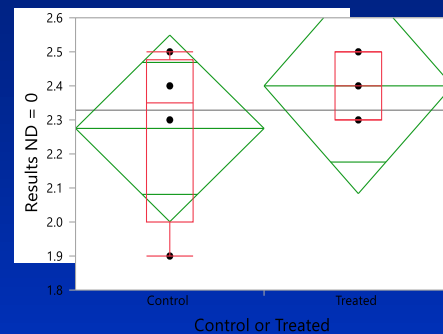
## Almond



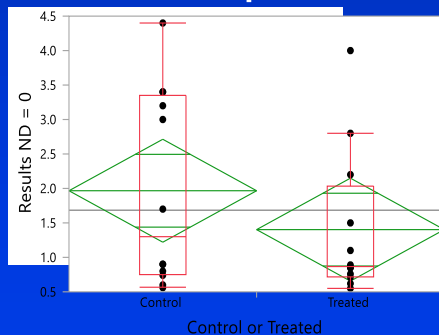
## Citrus



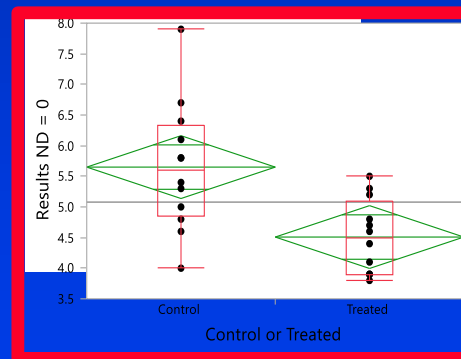
## Garlic



## Grape



## Pistachio



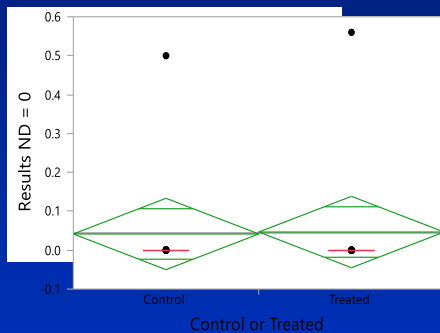


# Molybdenum

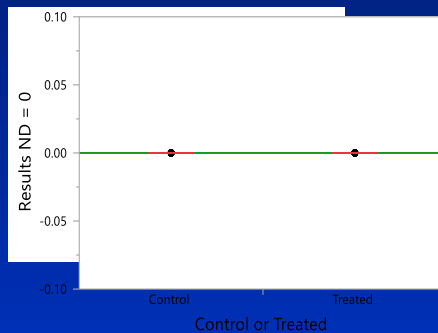
Units = mg/kg

Scales are different

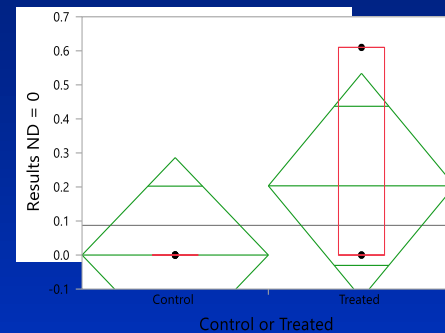
## Almond



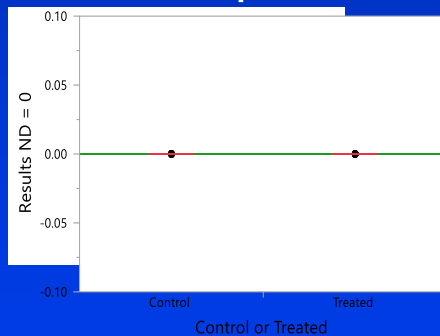
## Citrus



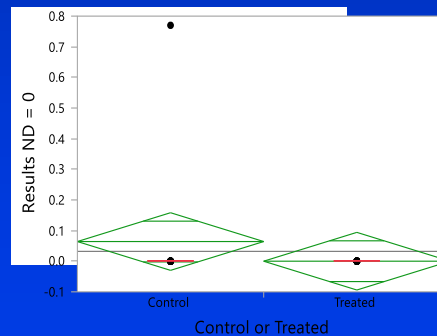
## Garlic



## Grape



## Pistachio

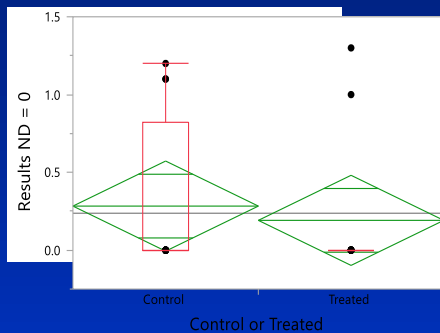


# Nickel

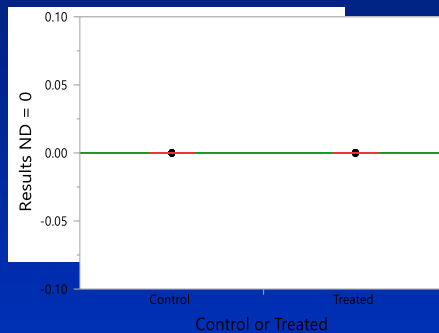
Units = mg/kg

Scales are different

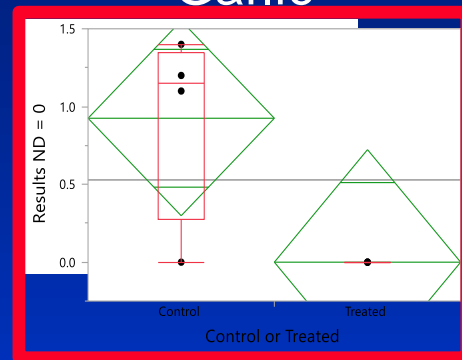
## Almond



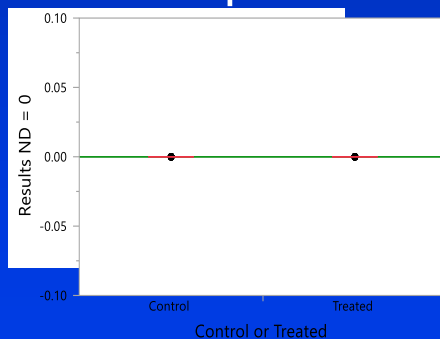
## Citrus



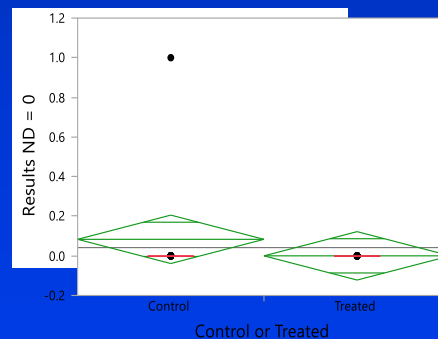
## Garlic



## Grape



## Pistachio

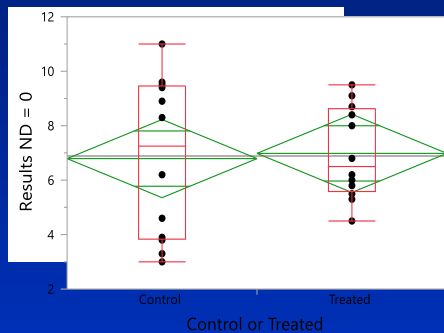


# Strontium

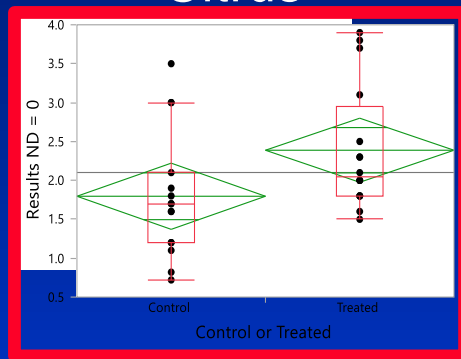
Units = mg/kg

Scales are different

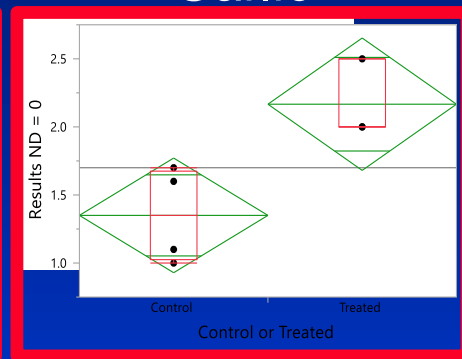
## Almond



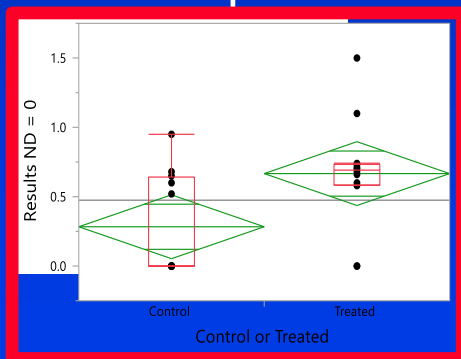
## Citrus



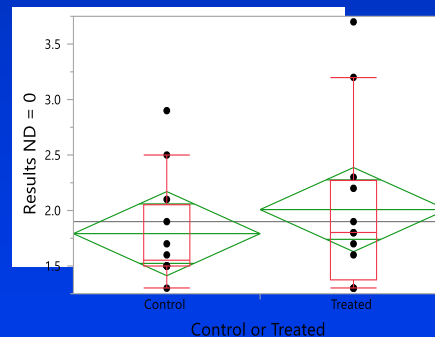
## Garlic



## Grape



## Pistachio

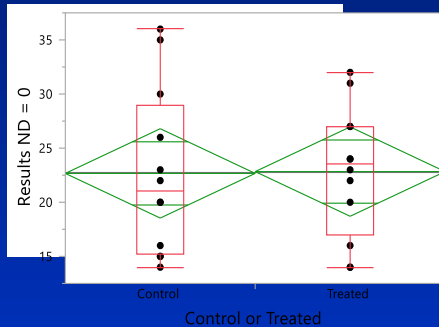


# Zinc

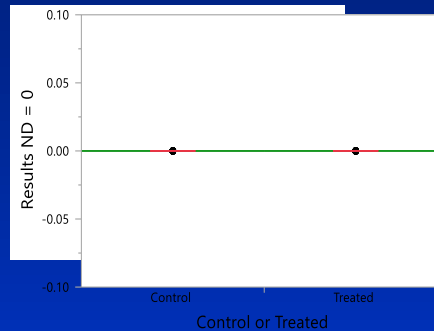
Units = mg/kg

Scales are different

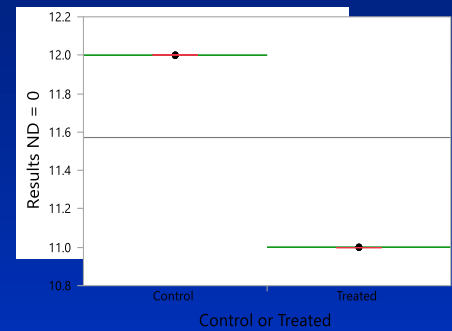
## Almond



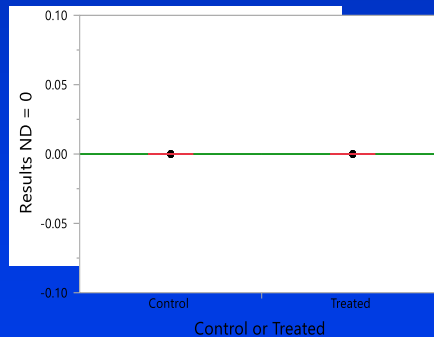
## Citrus



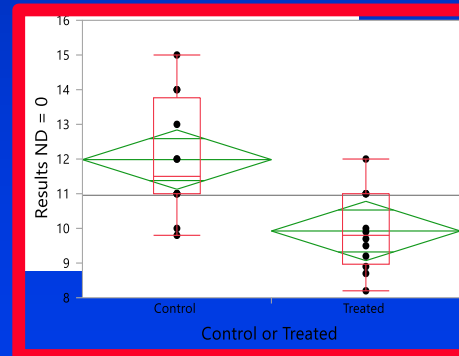
## Garlic



## Grape



## Pistachio



# Crop Sample Results

$\text{Max}_c$  = Maximum Concentration for Control Sites

$\text{Max}_T$  = Maximum Concentration for Treated Sites

- Control > Treated:

- ◆ **Copper**                       $\text{Max}_c = 9.9 \text{ mg/kg}$      $\text{Max}_T = 9.7 \text{ mg/kg}$
- ◆ **Nickel**                       $\text{Max}_c = 1.4 \text{ mg/kg}$      $\text{Max}_T = 1.3 \text{ mg/kg}$
- ◆ **Zinc**                         $\text{Max}_c = 36 \text{ mg/kg}$      $\text{Max}_T = 32 \text{ mg/kg}$

- Control ~ Treated:

- ◆ **Molybdenum**     $\text{Max}_c = 0.77 \text{ mg/kg}$      $\text{Max}_T = 0.61 \text{ mg/kg}$

- Treated > Control:

- ◆ **Barium**                       $\text{Max}_c = 1.9 \text{ mg/kg}$      $\text{Max}_T = 2.1 \text{ mg/kg}$
- ◆ **Strontium**                       $\text{Max}_c = 11 \text{ mg/kg}$      $\text{Max}_T = 9.5 \text{ mg/kg}$

# Potential Sources

- Sources of Consideration:
  - ◆ Herbicides / Pesticides,
  - ◆ Fertilizer / Nutrient Management,
  - ◆ Irrigation Water, and
  - ◆ Soil Classification.
- Selection of Control / Treated Sites
  - ◆ Farmers with property at Control & Treated Sites
- Irrigation Water
  - ◆ Irrigation water results at the outfall of Reservoir B are available
  - ◆ Looking at other water blended downstream of Reservoir B
- Soil
  - ◆ Soil classifications published by the United States Department of Agriculture

# Water Quality Results

## Barium (mg/l) Water Quality Results

Sec 1.a	Water Districts	Irrigation Water (post-blending)				
		Total No. of Results	Total Detectable Results	First Available Sample Result	Most Recent Available Sample Result	Min Result
	Cawelo Water District	9	9	Aug 1985	Dec 2017	0.027
	North Kern Water Storage District	8	8	Sep 2015	Dec 2017	0.016
	Kern-Tulare Water District and Jasmin Mutual Water Company	14	10	May 2012	Dec 2017	0.005

Sec 1.b	Operators	Produced Wastewater (pre-blending)				
		Total No. of Results	Total Detectable Results	First Available Sample Result	Most Recent Available Sample Result	Min Result
	Chevron & VVMC	14	13	Jul 1996	Dec 2017	0.0075
	California Resources Corporation	10	10	Sep 2015	Dec 2017	0.0021
	Hathaway, LLC	21	5	May 1967	Dec 2017	0

Title 22 Primary MCL (Drinking Water) = 1.0 mg/l

# Water Quality Results

## Strontium (mg/l) Water Quality Results

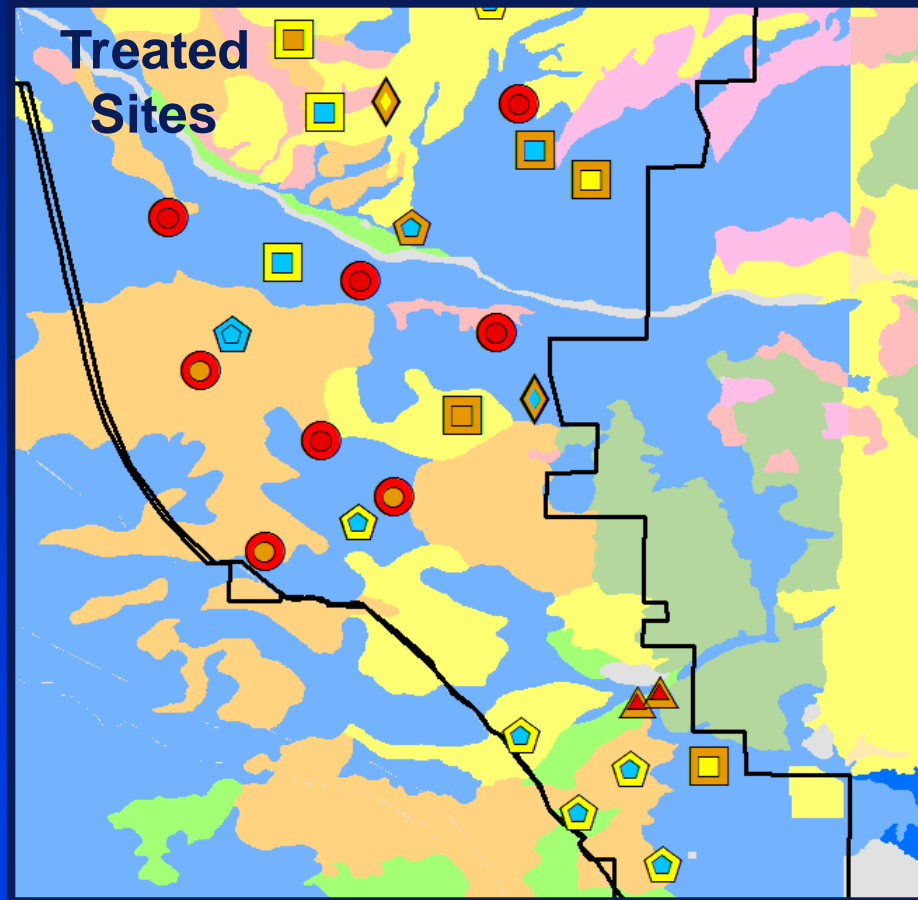
Sec 2.a	Water Districts	Irrigation Water (post-blending)				
		Total No. of Results	Total Detectable Results	First Available Sample Result	Most Recent Available Sample Result	Min Result
						Max Detectable Result
	Cawelo Water District	6	6	Apr 2015	Dec 2017	0.120
	North Kern Water Storage District	8	8	Sep 2015	Dec 2017	0.059
	Kern-Tulare Water District and Jasmin Mutual Water Company	12	9	May 2012	Dec 2017	0.018

Sec 2.b	Operators	Produced Wastewater (pre-blending)				
		Total No. of Results	Total Detectable Results	First Available Sample Result	Most Recent Available Sample Result	Min Result
						Max Detectable Result
	Chevron & VWMC	10	10	Jan 2012	Dec 2017	0.140
	California Resources Corporation	10	10	Sep 2015	Dec 2017	0.130
	Hathaway, LLC	18	14	Apr 2013	Dec 2017	0.085

Title 22 Primary MCL (Drinking Water) = NA



# Soil Classification Map



## Legend Soil Types

- Clay
- Clay Loam
- Silty-Clay
- Silty Loam
- Sand
- Fine-Sandy Loam
- Sandy Loam
- Coarse Sandy Loam
- Gravel
- Gravelly Loam
- Loam
- Complex
- Association
- Other
- Urban Areas
- Water

## Legend Fruit Sample Results

- Barium Results: <0.5 mg/kg
- Barium Results: 0.5-0.75 mg/kg
- Barium Results: 0.76-1.29 mg/kg
- Barium Results: 1.3-2.1 mg/kg
- Strontium Results: <0.25 mg/kg
- Strontium Results: 0.25 - 1.4 mg/kg
- Strontium Results: 1.5-4.9 mg/kg
- Strontium Results: 5.0 - 11.0 mg/kg

## Legend Fruit Sample Locations

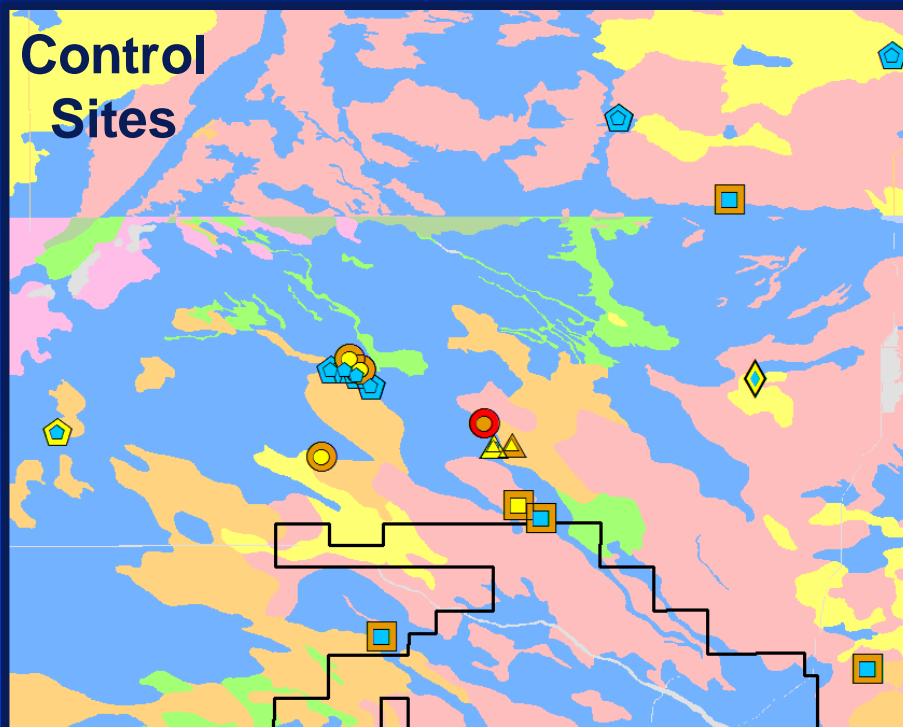
- Almond Sample Locations
- Citrus Sample Locations
- Garlic Sample Locations
- Grape Sample Locations
- Pistachio Sample Locations

# Soil Classification Map

**Control Sites**

## Legend Soil Types

- Clay
- Clay Loam
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- Silty Loam
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## Legend Fruit Sample Locations

- Almond Sample Locations
- Citrus Sample Locations
- Garlic Sample Locations
- Grape Sample Locations
- Pistachio Sample Locations

# Summary

- Water Quality Results

- ◆ Reviewed water quality results
- ◆ Water quality results have been shared with the Panel

- Soil Analysis Goals

- ◆ Comparison between soil type and crop sample results
- ◆ Look for potential trends
- ◆ Compare 2017 and 2018 data

- Soil Analysis Status

- ◆ Too few data points
- ◆ Wait for 2018 sample results to continue

# Questions ?

